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ABSTRACT

Science fairs represent the culmination of student research efforts under the guidance of teachers and other persons interested in science topics. The total scientific process should be involved in the development of a project which results in a science fair exhibition. The student should learn to recognize problems, plan an experiment, gather and analyze data, and draw conclusions. In doing this, students gain self-confidence and the respect of their peers and often spark a life-long interest in science. Fairs also help to strengthen the links between the school and the local community. This pamphlet discusses the science fair movement in North Carolina, including state rules, regulations and judging criteria, and how to plan, conduct and present a science project for a science fair. Also included is the North Carolina code of practice for using animals in schools, and eight references. (CW)

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# North Carolina State Science Fair HANDBOOK

## 1988 - 89

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**SPONSORED BY**
**North Carolina Science Teachers Association**
**Science Division, State Department of Public Instruction**
**North Carolina A&T State University**
**The University of North Carolina Mathematics and Science Education Network**
**The University of North Carolina at Greensboro**

## CONTRIBUTORS

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# NORTH CAROLINA STATE SCIENCE FAIR HANDBOOK

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## GENERAL INFORMATION

- Location: N.C. A&T State University Gymnasiums
  Greensboro, NC

- Date: Friday, April 28, 1989

- Entries: Entry forms are to be sent in by April 10, 1989. These forms will be provided by regional science fair directors.

- Divisions: Senior - Grades 9-12

  Junior - Grades 6-8

  Elementary - Grades 3-5

  Elementary Projects will be judged and approximately five projects will receive an "Exemplary Project" ribbon. All elementary projects will be put into one general category. A maximum of six projects from each of the eight regional fairs may be entered at the elementary level.

- Categories: There will be three categories for the Junior and Senior Divisions:

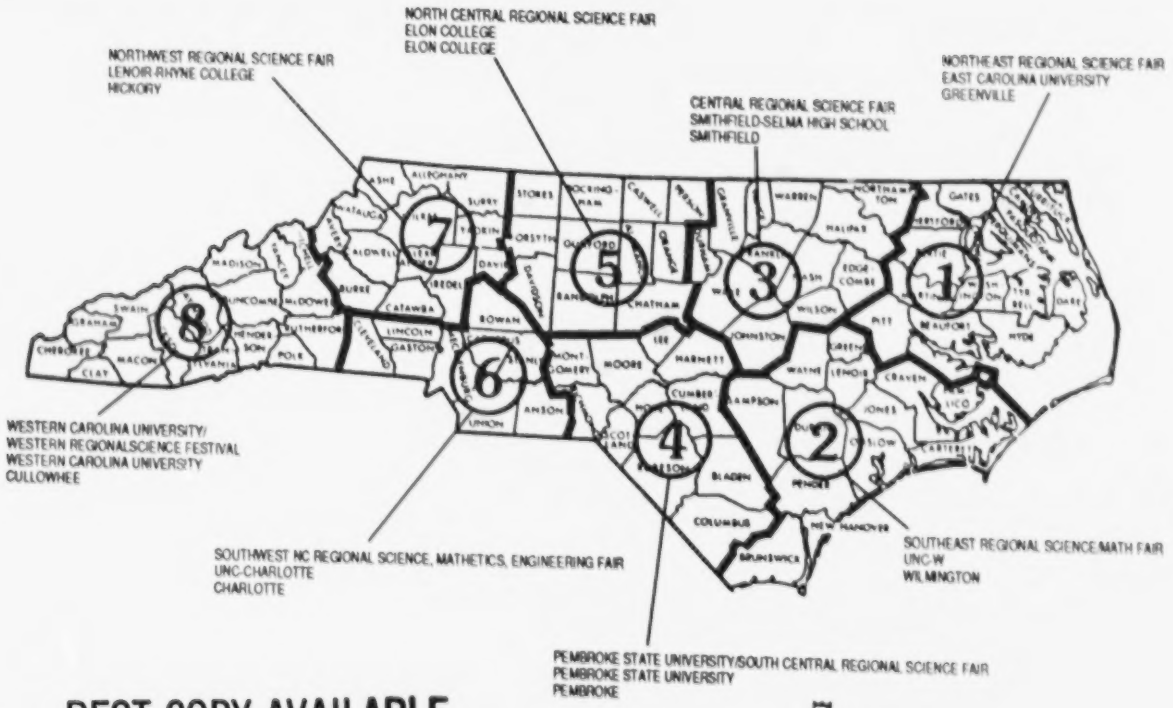
  1. Biological Science
  2. Physical Science
  3. Earth Science

Two entries from each of the three categories in the Junior and Senior Divisions will be allowed from each regional fair.

Only RESEARCH PROJECTS will be allowed at the Junior and Senior Division levels according to the N.C. State Science Fair competitive criteria.

Only entries from the eight state regional science fairs will be allowed to enter the State Science Fair.

# REGIONAL SCIENCE FAIRS - 1989

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## What Is a Science Fair?

Science fairs are an exhibition of scientific projects prepared and presented by students under the guidance of their teachers and with the help of other persons interested in the science topic being explored.

## The History of Science Fairs in North Carolina

During the 1950s, state and national interest in science resulted in the initiation of science fairs. At that time, several high schools required projects of students and held local science fairs. Winners of local fairs participated in district level competition, and those winners competed in a state science fair. In addition, the top state science fair entries (two students and their teacher/advisors) attended the national competition which was held annually in one of the large cities of the country.

During the 1960s and 1970s, interest in science fairs decreased, and many local and district science fairs were discontinued. Beginning in the 1980s, the participation in these events has grown substantially as educators, students and parents have shown increased interest in science-related activities, resulting in competition at the local, regional, and again at the state level in 1987.

## Why Have a Science Fair?

The total scientific process should be involved in the development of a scientific project which results in a science fair exhibition. The student should learn to recognize problems, plan an experiment, gather and analyze data, and draw conclusions. In doing this, he or she will hopefully develop self-confidence and gain respect of his or her peers. Often a science project or science fair can revitalize a science program and spark interest in a student untouched by routine class activities. In addition, the cooperative efforts of teachers, students, parents, local experts, and judges can strengthen the links between schools and community resources.

## What Is a Science Project?

A science project is based on observation, investigation and scientific thinking.

The best project is one which interests the investigator (student).

A true science project is an investigation of a question, involving research, planning, and application of the scientific method to seek an answer to the question.

## What Is the Scientific Method?

A successful project requires use of the "scientific method." That is not difficult; it only requires that the student: Observe, Plan, Experiment, and Explain what happens in the project.

Usually applied in a series of steps, the scientific method includes:

> Observing a single event or a group of events and recognizing a problem.
>
> Identifying a question to be asked.
>
> Formulating a hypothesis or attempting to explain what should happen.
>
> Designing and planning for experimentation or testing of the hypothesis.

In order to form a generalized conclusion, an investigation must include a number of observations of the events being investigated. For example, if the question is "Does the presence of sunlight affect the growth of petunia plants?" then a dozen petunia plants must be examined over a time interval in the presence of sunlight (experimental group), while another dozen plants must be subjected to the same conditions but in the absence of sunlight (control group). Using one of two plants in each group will not produce a valid investigation.

Conducting the experiment - Keep daily records, recording observations

in an orderly manner in tables and charts. Be certain observations include the units of measurement being used. Determine whether results recorded in tables can be more easily understood with the use of graphs. All graphs must have a title which tells the reader what the graph is explaining. The abscissa (x-axis) and ordinate (y-axis) should be labeled indicating the units and dimensions.

Drawing conclusions - Making sense of what has been observed.

Making a generalization based on observations and results.

## Selecting a Project

When deciding on a topic to investigate, ask these questions:

What topic interests me? What is a question for which I would like to seek an answer?

Is this question too difficult for me to solve?

What materials will be needed? Does this problem require sophisticated or expensive materials?

Is the problem a safe one?

Is it a valid one? Will it be possible to obtain results from this investigation?

Is it of significance to today's society?

In choosing a project title, it is best to state the title in question form, such as, "what are," "how is," or to use such phrases as:

The Effects of...

A Comparative Study of...

The Observation of...

An Investigation of..

A Study of...

Computer Use

Using a computer to assist in conducting the investigation is acceptable. Development of a computer program, or a project that focuses primarily on the computer is NOT an appropriate type of investigation.

## Planning and Conducting the Investigation

To ensure that science fair projects are done well, they should be started no later than the beginning of the school year. The student should make a planning timetable so that there will be sufficient time to carry out all the steps in the process. Below is a suggested timetable and plan of action to help give direction.

| WEEK | |
|---|---|
| 1-2 | Select a problem/begin research. Read publications, textbooks, and reference books. Consult teachers and other scientists who might help you. |
| 3-4 | Continue research. Design experiments, method of investigation. Discuss ideas with others. |
| 4-5 | Collect material needed. Set up necessary equipment to do experiments. Outline research paper. |
| 5-13 | Begin experiments. Complete experiments. Be sure to set aside time for observing and recording each day. When making observations and recording results organize data in orderly tables and charts. |
| 13-16 | Interpret results and data, draw conclusions, consider applications. Consult with teachers or other scientists. Construct models, illustrations and/or displays. Finish research paper. Prepare for oral presentation of the project report. Remember, some of the most useful information can come from talking to other people who are interested in your topic. |

## I. Research Paper

A report of the research should be presented in a formal research paper. A suggested format follows:

A. Title

B. Abstract - A brief condensation of the entire report, in one page or less

C. Statement of the problem

D. Experimental methods

E. Results - This may include tables and graphs

F. Conclusions

G. References - Use correct bibliographic form in repeating references. One quick means of determining correct form is to look at an article in a scientific publication, such as SCIENTIFIC AMERICAN, SCIENCE, THE SCIENCE TEACHER, JOURNAL OF CHEMICAL EDUCATION or AMERICAN BIOLOGY TEACHER. Note the bibliographic form used in references at the end of an article in a recent issue of one of these journals.

## II. Suggestions

A. ***Do the work yourself***

This is your project! One purpose of the science fair is to encourage you to do experiments. Do most of the work yourself; develop the idea on your own. Ask a question and then design an experiment to try to answer it.

You are encouraged to get advice from others, and you may need them to help with construction of an apparatus, but the project should be basically your project.

B. Start early

It always takes longer than you think to do a good science project. You may have delays getting materials, construct- ing the apparatus, writing the report, or making the display. Your proposed project may not work as you feel it should, and you may wish to start another one.

C. Work regularly

Do not put if off until you have time; make time! Set aside a regular time to work even if only for a short time.

## III. Science Exhibit

Displays will be restricted to a space 122 cm wide (side to side), 76 cm deep (front to back), 198 cm in height (from tabletop), or 274 cm in height (floor to top). If electricity is required for the display that should be indicated on the entry form.

## IV. Oral Presentation

Students should be at their exhibit during judging at the State Fair. Judges may have some questions about your project.

A. Questions commonly asked by judges

- "Tell me about your project."
- "What did you find out?"
- "Why did you do your project this way?"
- "What does that word mean?"
- "Why do you think your results turned out the way they did?"
- "If you were going to study this more, what would you do next?"

B. Suggestions

- Be able to explain your project in 1/2 to 1 minute.
- Talk clearly and simply. Act interested and enthusiastic.
- Dress neatly and attractively.
- Practice your talk before others. Get others to ask you questions; learn answers to questions that you do not know.

## Code of Practice on Use of Animals in Schools

The North Carolina State Science Fair Code of Practice on Use of Animals in Schools is a revision of the NSTA Code which is recommended for use throughout the United States by elementary, middle/junior high, and high school teachers and students. The NSTA code was modified for use by teachers and students in N.C. schools.

The purpose of the code is to enrich education by encouraging students to observe living organisms and to learn proper respect for life. The study of living organisms is essential for an understanding of living processes. Study should be coupled with the observance of humane animal care and treatment.

### I. Care and Responsibility for Animals in the Classroom

A. A student must have a clear understanding of and a strong commitment to the responsible care of living animals before making any decision to use live animals for educational study. Preparation for the use of live animals should include acquisition of knowledge on care appropriate to the species being used including housing, food, exercise, and the appropriate placement of the animals at the conclusion of the study.

B. Students should try to assure that living animals associated with their projects are healthy and free of transmissible disease or other problems that may endanger human health. Not all species are appropriate. Wild animals are not appropriate because they may carry parasites or serious diseases.

C. Maintaining good health and providing optimal care based on an understanding of the life habits of each species used is of primary importance. Animal quarters shall be spacious, shall avoid over-crowding, and shall be sanitary. Handling shall be gentle. Food shall be appropriate to the animal's normal diet and of sufficient quantity and balance to maintain a good standard of nutrition at all times. No animal shall be allowed less than the optimum maintenance level of nutrition. Adequate provision for care shall be made at all times including vacation times.

D. All aspects of animal care and treatment shall be supervised by a qualified ADULT WHO IS KNOWLEDGEABLE ABOUT RESEARCH METHODS, BIOLOGY, CARE, AND HUSBANDRY OF THE SPECIES BEING STUDIED.

E. Supervisors and students should be familiar with literature on care and handling of living organisms. Practical training in these techniques is encouraged.

F. Adequate plans should be made to control possible unwanted breedings of the species during the project period.

G. Appropriate plans should be made for future care of the animals at the conclusion of the study.

H. As a general rule, laboratory bred animals should not be released into the wild as they may disturb the natural ecology of the environment.

I. The procurement, care and use of animals must comply with existing local, state, and federal regulations.

## II. Experimental Studies of Animals in the Classroom

A. When biological procedures involving living organisms are called for, every effort should be made to use plants or invertebrate animals when possible.

B. No experimental procedure shall be attempted on mammals, birds, reptiles, amphibians or fish that cause the animal unnecessary pain or discomfort.

C. It is recommended that preserved vertebrate specimens be used for dissections.

D. Students shall not perform dissection surgery on vertebrate animals.

E. Behavior studies should use only reward (such as providing food) and not punishment in training programs. When food is used as a reward, it should not be withheld for more than 12 hours.

F. Embryos should not be subjected to invasive or potentially damaging experimental manipulation.

## III. Research Investigations Involving Invertebrate Animals

The National Science Teachers Association recognizes that an exceptionally talented student may wish to conduct research in the biological or medical sciences and endorses procedures for student research as follows:

A. Protocols of extracurricular projects involving animals should be reviewed in advance of the start of the work by a qualified adult supervisor.

B. Preferably, extracurricular projects should be carried out in an approved area of the school or research facility.

C. The project should be carried out with the utmost regard for the humane care and treatment of the animals involved in the project.

## The North Carolina State Science Fair Official Rule and Regulations

1. Each exhibit must be preregistered using the Official Exhibit Entry Form. The entry form must contain endorsing signatures of the student exhibit-or(s) and the regional fair director and be completed in full in order to compete.

2. Exhibitors should arrive early enough to check-in, pick up exhibit space number, and set up their exhibits.

3. *Any exhibit/exhibitor that does not follow the Official Rules as stated on the Official Exhibit Entry Form will be disqualified and the exhibit will not be judged.*

4. Only entries from the eight regional science fairs will be allowed. Two entries from each of the three categories in the Junior and Senior Divisions will be allowed from each regional fair. Only research projects will be allowed at the Junior and Senior levels. The Elementary Division will be limited to six projects from each regional fair.

5. In the Senior Division, no more than one student may enter a project. In the Junior Division, no more than two students may enter a project. In the Elementary Division, no more than three students may work together on a project.

6. Only students enrolled in grades 3, 4, or 5 may compete in the Elementary Division. Only students enrolled in grades 6, 7, or 8 may compete in the Junior Division. Only students enrolled in grades 9, 10, 11, or 12 may compete in the Senior Division.

7. Displays will be restricted to a space 122 cm wide (side to side), 76 cm deep (front to back), and 198 cm in height (from tabletop) or 274 cm in height (floor to top). If electricity is required for the display, that should be indicated on the entry form.

8. Experimental procedures with animals which involve diets deficient in essential nutrients, discomfort, pain or death, will be disqualified. The State Science Fair Code of Practice on Use of Animals in Schools will be strictly adhered to - no live animals should be brought to the fair.

9. Dangerous items associated with students' projects are not allowed on the exhibit floor. Dangerous items include, but are not limited to, the following:

    Toxic, caustic, flammable, or explosive chemicals
    Harmful bacteria, or human parasites
    Ionizing radiation
    High voltage/amperage electric equipment or improperly shielded electrical equipment

10. No gas or running water will be available for exhibits.

11. Teachers or exhibitors should bring hardware such as screwdriver, hammer, electrical adapter, etc. needed to set up projects.

12. Individuals must assume all liability and responsibility for items associated with their exhibit.

13. The State Science Fair Director may refuse permission for any project to exhibit for reasons of safety, sanitation, or best interest of the Fair.

## JUDGING CRITERIA

Students will be present during part of the judging to answer questions. Student interviews will begin at 1:00 p.m.

**1. Creative Ability** **30 points**

Does the project show originality of thinking and investigation of an original idea?

**2. Scientific Thought** **30 points**

Does the project show evidence of well-organized work and use of scientific methods in investigating the problem?

**3. Skill** **10 points**

Does the project show evidence of careful workmanship, and a clearly organized presentation of the steps taken in conducting the investigation and presenting results and conclusions?

**4. Thoroughness** **10 points**

Does the project give a complete explanation of the scientific principle or process involved?

**5. Clarity and Dramatic Presentation** **10 points**

Is the project presented in a manner that is easily understood, with an attractive layout that commands the attention of viewers with a clearly defined and well-labeled display?

**6. Interview** **10 points**

Is the student knowledgeable in areas covered by the research?

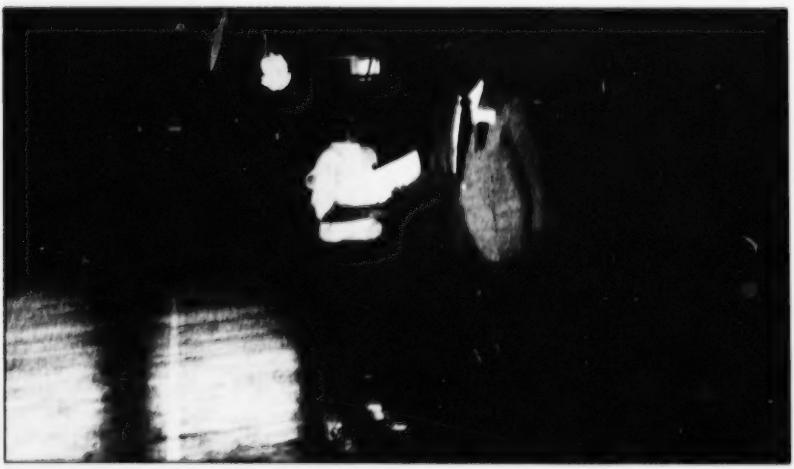
# 1988 State Science Fair Winners

Kimberley Hensley - First Place Gold Medal Winner
Senior Earth Science - Enka High School, Enka

Mark Allen - First Place Gold Medal Winner - Junior Earth Science
J.T. Williams Jr. High School, Charlotte

# 1988 State Science Fair Winners

Jonathan Li - First Place Gold Medal Winner, Senior Physical Science
J.H. Rose High School, Greenville



Travis Baldwin - First Place Gold Medal Winner
Junior Physical Science - Roland-Grise School, Wilmington

# 1988 State Science Fair Winners

Maricelina Caro - First Place Gold Medal Winner
Senior Biological Science - Aycock Junior High School, Greenville

David Martin - First Place Gold Medal Winner, Junior Biological Science
West Cary Junior High School, Cary

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Weaver, Elbert C., Chemistry Projects and Science Fairs For a copy write: Dr. Robert E. Varnerin, Manager of Education, Chemical Manufacturers Association, 2501 M Street, N.W., Washington, DC 20037.